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Technical Report 149

SHORELINE BIRD INVENTORIES IN THREE NATIONAL PARKS IN HAWAII: KALAUPAPA NATIONAL HISTORICAL PARK, HALEAKALA NATIONAL PARK AND HAWAII VOLCANOES NATIONAL PARK

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ABSTRACT

Shoreline bird surveys were conducted in Kalaupapa National Historical Park (KALA), Haleakala National Park (HALE), and Hawaii Volcanoes National Park (HAVO) to inventory avian species diversity and relative abundance. Seasonal migrants (waterfowl, shorebirds) were the primary focus of the routine surveys, but seabirds, raptors, and waterbirds were also recorded as encountered. The coastline of KALA was surveyed once over a two-day period, 5-6 April 2005. The park coast consists of sandy and rocky beaches, steep rock cliffs adjoining grassy pastures, and uninhabited offshore islets. Two nonadjacent coastline segments in HALE, Kipahulu and Kaapahu, were surveyed twice each over a two-day period, 30-31 March 2005. The coast consists of steep rock cliffs adjoining grassy pastures and rocky beaches. Bird surveys were conducted along shorelines in and adjacent to HAVO. Each coastal segment was surveyed continuously throughout the day between 7-17 March 2005. Although much of the shoreline of HAVO is characterized by steep lava cliffs, shoreline habitat also includes small sand and cobble beaches, anchialine pools, tide pools, and periodically inundated areas. Pacific Golden Plovers (*Pluvialis fulva*), Wandering Tattlers (*Heteroscelus incanus*), and Ruddy Turnstones (*Arenaria interpres*) are common seasonal migrants that were observed along the survey routes. Five seabird species common to the Hawaiian Islands, Great Frigatebird (*Fregata minor*), Wedge-tailed Shearwater (*Puffinus pacificus),* Black Noddy (*Anous minutus*), Red-tailed Tropicbird (*Phaethon rubricauda*) and White-tailed Tropicbird (*Phaethon lepturus*) were observed as well. Sooty Terns (*Sterna fuscata*) were heard at night, and a Black-crowned Night Heron (*Nycticorax nycticorax*) and a Bonaparte's Gull (*Larus philadelphia*) were seen in HAVO. An unknown booby species, most likely Red-footed Booby (*Sula sula*) was seen on the offshore islets of KALA. The introduced Cattle Egret (*Bubulcus ibis*), a heron that thrives in pastures near open water, was abundant throughout the HALE survey. All passerine species observed along the shoreline route were non-native. No waterfowl or raptors were observed during the survey.

INTRODUCTION

Kalaupapa National Historical Park (KALA) on the island of Molokai, Hawaii consists of 4,856 hectares of land on the northern shore of the island. The park coast, from Awahua Beach to the Waikolu Valley River, is 13 km long. Beaches, rocky shorelines, steep cliffs, and uninhabited islets provide suitable habitat for migrant shorebirds and breeding seabirds (Figures 1 and 2). A seabird survey by boat was conducted in 1996 (Hodges 1996), but shorebirds were not present due to the timing of the survey, which took place in the summer. Haleakala National Park (HALE) on the island of Maui, Hawaii consists of 11,849 hectares from the summit of Haleakala to the coast at Kipahulu and Kaapahu. The park coast is 3.8 km long and consists of steep rock cliffs adjoining grassy pastures and rocky beaches (Figure 3). Hawaii Volcanoes National Park (HAVO) on the island of Hawaii consists of 135,086 hectares from the summit of Mauna Loa to the Puna Coast and west toward Kona (Kahuku). HAVO's 52.6 km of coastline is characterized by steep rocky cliffs, small sandy and rocky bays and beaches with adjoining unvegetated

pahoehoe and aa lava, and sparsely vegetated lava uplands (Figures 4 and 5). The variable habitat along this long stretch of coastline is described in more detail in the appendix. No shoreline bird survey of this scope had been conducted at HAVO. Previous bird surveys had been conducted at HAVO (Banko and Banko 1979; Conant 1980) but none had systematically surveyed coastal species. Shoreline bird observations have been incidentally and sporadically made by volunteers and staff of the Hawksbill Turtle Project, who have been present at remote beaches in the park during summer and fall. Their presence at these sites, however, does not coincide with the time that wintering shorebirds and waterfowl are most abundant.

Figure 1. Iliopi Beach, Kalaupapa National Historical Park, 5 April 2005.

Figure 2. Okala (left) and Huelo (right) Islets, Kalaupapa National Historical Park, 6 April 2005.

Figure 3. Puhilele Point, Haleakala National Park, 30 March 2005.

Figure 4. Halape, Hawaii Volcanoes National Park, March 2005.

Figure 5. Hawaii Volcanoes National Park coastline, March 2005.

Shorebirds

Several species of shorebirds migrate from their northern nesting grounds to spend the winter, from late summer to spring, in Hawaii. Pacific Golden Plover (*Pluvialis fulva*), Wandering Tattler (*Heteroscelus incanus*), Ruddy Turnstone (*Arenaria interpres*), and Sanderling (*Calidris alba*) are shorebirds that are common migrants to the Hawaiian Islands, and Bristle-thighed Curlew (*Numenius tahitiensis*) are observed occasionally. Pacific Golden Plover migrations from their breeding grounds in Russia and Alaska often involve long, nonstop transoceanic flights (Johnson and Connors 1996). Hawaii contains some of the most important wintering grounds in the world for this species (Johnson 2004). Pacific Golden Plover are very adaptable to the various habitats of Hawaii. Birds use areas such as pastures, coastal salt marshes, mudflats, coralline flats, beaches, grassy borders of airport runways and taxiways, athletic fields, parks, residential lawns, golf courses, and roadsides. They range in elevation from sea level to 2,500 m on mountain slopes where habitat is suitable, that is, where pastures are present (Johnson and Connors 1996).

Oceania from the Hawaiian Islands southward is the main nonbreeding area for the Wandering Tattler. Their long- to intermediate-distance migration from breeding sites in Alaska, Yukon, and Russia to their southern wintering grounds begins in mid-July (Gill et al. 2002). Observations of wintering individuals indicate high site fidelity throughout the nonbreeding season (Gill et al. 2002). Wandering Tattlers frequent rocky shorelines and rocky streams, but soft substrates, especially at river mouths and tidal flats, are utilized as well.

Ruddy Turnstones are a widely distributed shorebird, with breeding sites from eastern Russia across Alaska and Canada to Greenland (Nettleship 2000). The breeding population from western Alaska and eastern Russia migrate to southeast Asia, Australia and western Pacific, including Hawaii. Ruddy Turnstones show site fidelity to their wintering grounds. Wintering birds are almost exclusively coastal, mostly using stony and rocky shorelines, but are also common on mudflats, sandflats, deltas and open grassy fields (Nettleship 2000).

Bristle-thighed Curlews are unique in that they are the only migratory shorebird to winter exclusively on oceanic islands (Marks et al 2002). They fly at least 4,000 km nonstop between their breeding sites in Alaska and the northern end of their winter range in the Northwestern Hawaiian Islands, making one of the longest nonstop flights known for any bird. The highest number of wintering birds are reported in the Northwestern Hawaiian Islands, though small numbers overwinter in the main Hawaiian Islands (Marks et al 2002). Bristle-thighed Curlews occupy open grassy areas, vegetated dunes, and wetlands on the main Hawaiian Islands, and beaches, coral ledges at shoreline, as well as grass-and forb-dominated interior areas on the Northwestern Hawaiian Islands.

Sanderlings are a widely distributed shorebird with breeding sites in arctic North America, Russia, Greenland, and Norway, wintering worldwide on temperate and tropical marine beaches (MacWhirter et al. 2002). Sanderlings prefer sandy beaches, but are also found on exposed reefs, mudflats, or open ground inland (Pratt et al. 1987). The

coastlines in and near the three national parks surveyed provide abundant habitat for these wintering migratory shorebirds.

Seabirds

Estimating seabird population sizes is a challenging task. Baseline estimates of breeding seabird pairs are generally agreed to be more useful than estimates of total population size (Harrison 1990). Most seabirds in Hawaii nest in the spring and summer months when a greater abundance of food is available. Longer days, which provide more daylight available for feeding and superior weather in summer months, also influence when seabirds nest. There are a few exceptions, such as the Black Noddy (*Anous minutus*), which nests in winter and feeds in nearshore waters with schools of resident predatory fish.

The main Hawaiian Islands were once home to a diverse and vast assemblage of seabirds. The major cause of their extinction, extirpation, and decline was the extensive clearing of lowland forests by early Polynesian settlers in addition to predation by rats (*Rattus exulans*), which arrived in the islands with the settlers (Olson and James 1982). Today there are several factors negatively influencing nesting of seabirds on the main Hawaiian Islands, including the national park coastlines. HALE's Puhilele Point is recently acquired land that was grazed by cattle until 2004. Habitat loss and land use change such as ranching eliminated some seabird-nesting habitat. In some areas direct human disturbance may prevent nesting of White- and Red-tailed Tropicbirds (Brenda Zaun, pers. comm.). One of the most important threats to nesting seabirds is predation by alien mammals (Hodges 1996). Polynesian rats (*Rattus exulans*) have been documented preying upon ground-nesting seabirds such as Bulwer's Petrel (*Bulweria bulwerii*), Laysan Albatross *(Phoebastria immutabilis*), Wedge-tailed Shearwater (*Puffinus pacificus*), and Bonin Petrel (*Pterodroma hypoleuca*; Tomich 1986). Mongooses (*Herpestes auropunctatus*) and feral dogs (*Canis familiaris*) are abundant in low elevations and contribute to seabird nesting failures (Stone 1985). Feral cats which range from sea level, where populations are higher, to sub-alpine areas of Maui and Hawaii also prey on ground nesting birds (Simons 1983, Natividad Hodges 1994, Winter 2003). On Oahu, where trap-neuter and release programs for cats exist near nesting seabird colonies considerable predation has resulted (Smith et al. 2002). As a consequence, many seabirds that were once common in the main islands now breed only on the predator-free Northwestern Hawaiian Islands.

Despite the presence of predators, there are still several species of seabirds that nest along the coast in the main Hawaiian Islands. These include the White-tailed Tropicbird (*Phaethon lepturus*), Wedge-tailed Shearwater, Red-tailed Tropicbird (*Phaethon rubricauda*), Great Frigatebird (*Fregata minor*), Red-footed Booby (*Sula sula*), Black Noddy, and Brown Noddy (*Anous stolidus*).

White-tailed Tropicbirds nest in shaded rock cavities along coastal headlands or high in the escarpment along the coast whereas Black Noddies lay eggs on ledges of cliffs or rocky outcrops. The park coastlines in Hawaii have ample habitat that may be inaccessible to predators. Species that nest on the ground include the Red-tailed Tropicbird and Brown Noddy. Wedge-tailed Shearwaters nest in burrows that they have

dug up to several meters deep in the soil. Great Frigatebirds and Red-footed Boobies nest in vegetation ranging from only a few centimeters off the ground up to four meters high.

Shoreline bird surveys were conducted to inventory avian species diversity and relative abundance and to characterize habitat use. Seasonal migrants (waterfowl, shorebirds) were the primary focus of the routine surveys, but seabirds, raptors, and waterbirds were also recorded as encountered.

Objectives

It is the goal of the National Park Service Inventory and Monitoring program to document 90% of vertebrates in the national parks. The shoreline bird inventories were conducted to aid in achieving this goal. Similar inventories have been conducted for other parks in the Pacific Island Network (O'Connor and Rauzon 2004, Waddington 2005a, 2005b). The objectives were to inventory avian species diversity and relative abundance and to characterize habitat use at KALA, HALE and HAVO. Seasonal migrants (waterfowl, shorebirds) were the primary focus of the routine surveys, but seabirds, raptorial species, and waterbirds were also recorded as encountered. Only relative abundance of species was determined. No attempt was made to estimate the number of breeding pairs or population sizes.

METHODS

Shorebirds, indigenous waterbirds, and migrants were surveyed along park shorelines on foot using a prescribed route. The surveyors scanned the coastline, 50 m offshore, and 50 m inland for shorebirds and seabirds at regular intervals using binoculars. Observer initials were recorded as were the date and observation start and end times. Tide level and weather variables were recorded for each survey. Temperature, cloud cover, estimated to the nearest 10%, wind and gust according to the Beaufort scale and rain, based on a 0-4 scale, were recorded. Each bird observed was counted and a Global Positioning System (GPS) location recorded, or distance and bearing estimated from a known GPS location. The habitat in which the bird was observed was recorded. Habitats were classified as follows: air over water, air over land, grass, grass and naupaka (*Scaevola sericea*), grass and other vegetation, grass and rock, naupaka, hala (*Pandanus tectorius*), other tree species, sand, rock, sparsely vegetated pahoehoe, sea cliffs, rocky shoreline, and other. The route was mapped and documented using a GPS Trimble GeoExplorer XT using the Universal Transverse Mercator, North American Datum 1983, Zone 4N or 5N. Data were entered into a Microsoft Access database and maps were created using ArcGIS 9.1. Species presence information was also entered into NPSpecies, the National Park Service Biodiversity Database.

Kalaupapa National Historical Park

The KALA inventory was conducted by one observer. The survey started at Awahua Beach at 0630 on 5 April 2005 and continued east along the coast to the Old Fishing Shack on the eastern shore of the peninsula. The survey ended at 1105. The survey route

continued on 6 April 2005 at 0642 at the Old Fishing Shack and continued to the eastern end of Waikolu Valley, ending at 1000 (Figure 6).

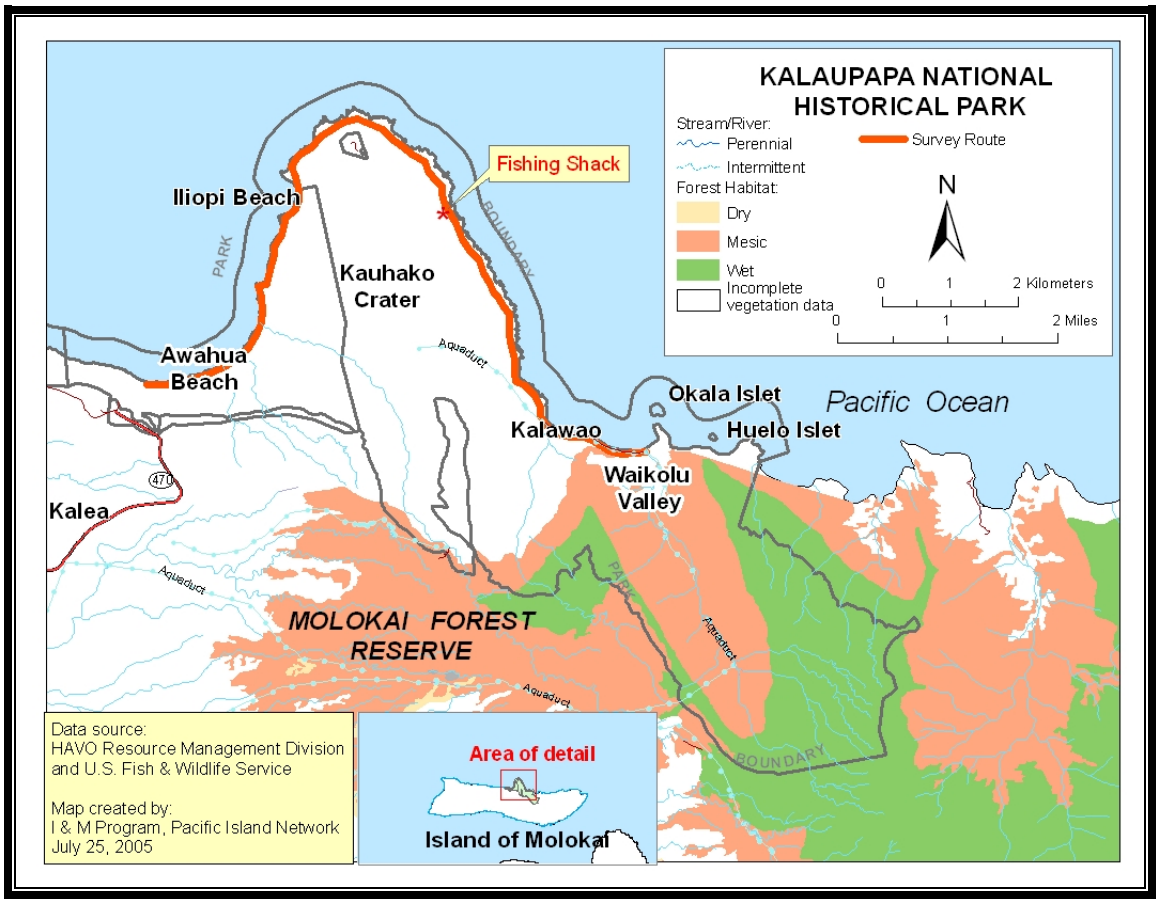

Figure 6. Map showing the shoreline bird inventory route, Kalaupapa National Historical Park, 5-6 April 2005.

Two additional shoreline inventory surveys were conducted during the fall of 2003 at KALA. Although the survey route was the same, the methodologies of these surveys differed slightly. Therefore, observations from the 2003 surveys will only be included in this report anecdotally. Also included were any incidental observations by the KALA Inventory Coordinator, Susan Marshall, that have occurred at KALA outside of the prescribed survey time period.

Haleakala National Park

The HALE inventory was conducted by a team of three observers. The survey started in Kipahulu at 0700 on 30 March 2005 at Oheo Stream, and continued south along the coast to Puhilele Point. The survey ended at 0938. The Kaapahu section of coastline was surveyed from 1200 until 1232 on 30 March 2005. Due to the nature of the coastline along part of the Kaapahu section, which is a rough single-lane road with a steep cliff on one side and a sheer drop to the ocean on the other side, this section of Kaapahu was surveyed from the rocky beaches on either end of the narrow stretch of road. On 31 March 2005 the Kaapahu section was surveyed from 0656 to 0727, and Puhilele Point was surveyed from 0755 to 0840. The coastline to Oheo Stream from Puhilele Point was not surveyed due to inclement weather (Figure 7).

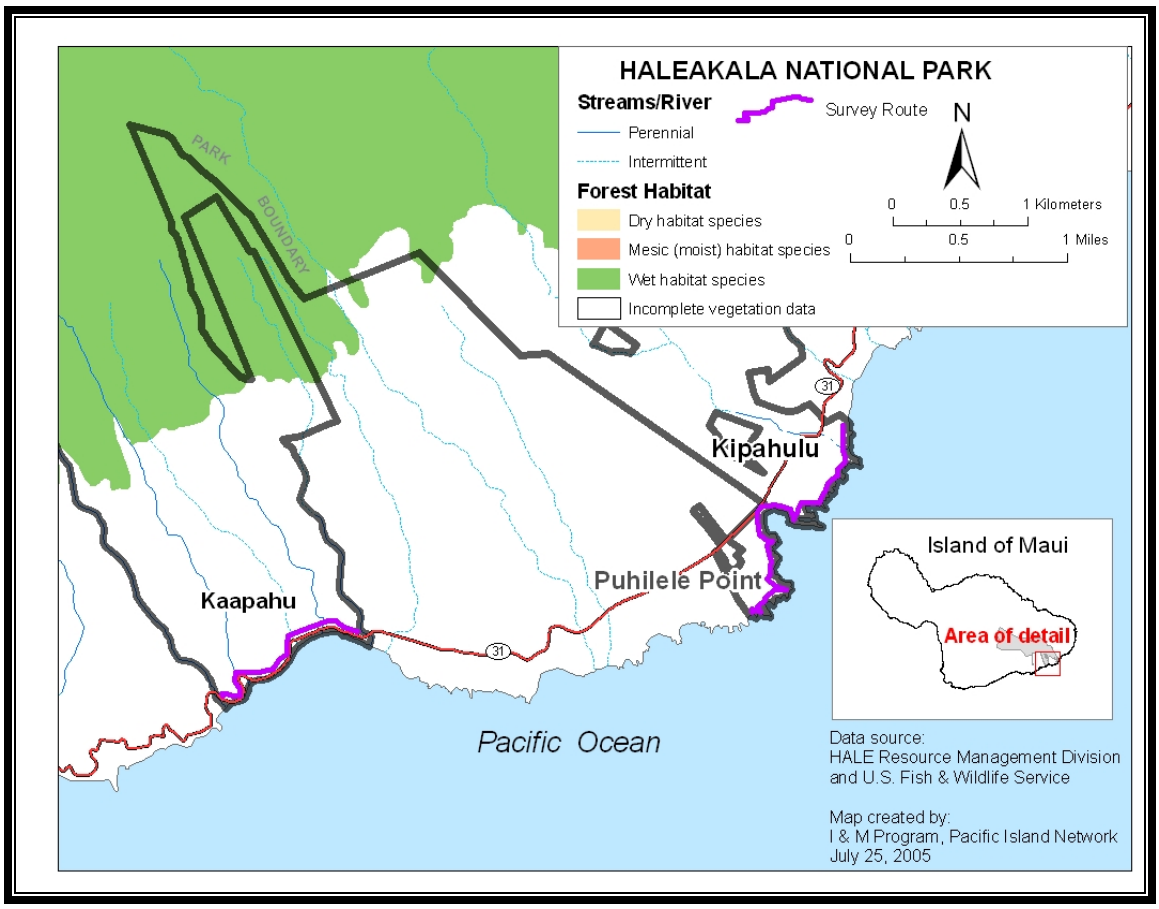

Figure 7. Map showing the shoreline bird survey areas, Kaapahu and Kipahulu, Haleakala National Park, 30-31 March 2005.

Hawaii Volcanoes National Park

The inventory was conducted on foot along the shoreline of HAVO and an adjacent coastline segment west of the park. Surveys began on 7 March 2005 at the southwestern

(Kau) coastal boundary of Hawaii Volcanoes National Park where the boundary fence meets the ocean. A team of three people walked southwest, surveying approximately 14 km of coast outside the park, ending the one-day survey at Punaluu Beach Park. Two observers walked northeast from the Kau park boundary, covering approximately 48 km of coastline within the park, and ending near the active lava flows at Laeapuki on March 17th. The last 5 km of coastline before the eastern boundary of HAVO were not surveyed because of its remote location, hazards due to nearby active lava flows, and because the barren new lava was probably not appropriate shoreline bird habitat (Figure 8).

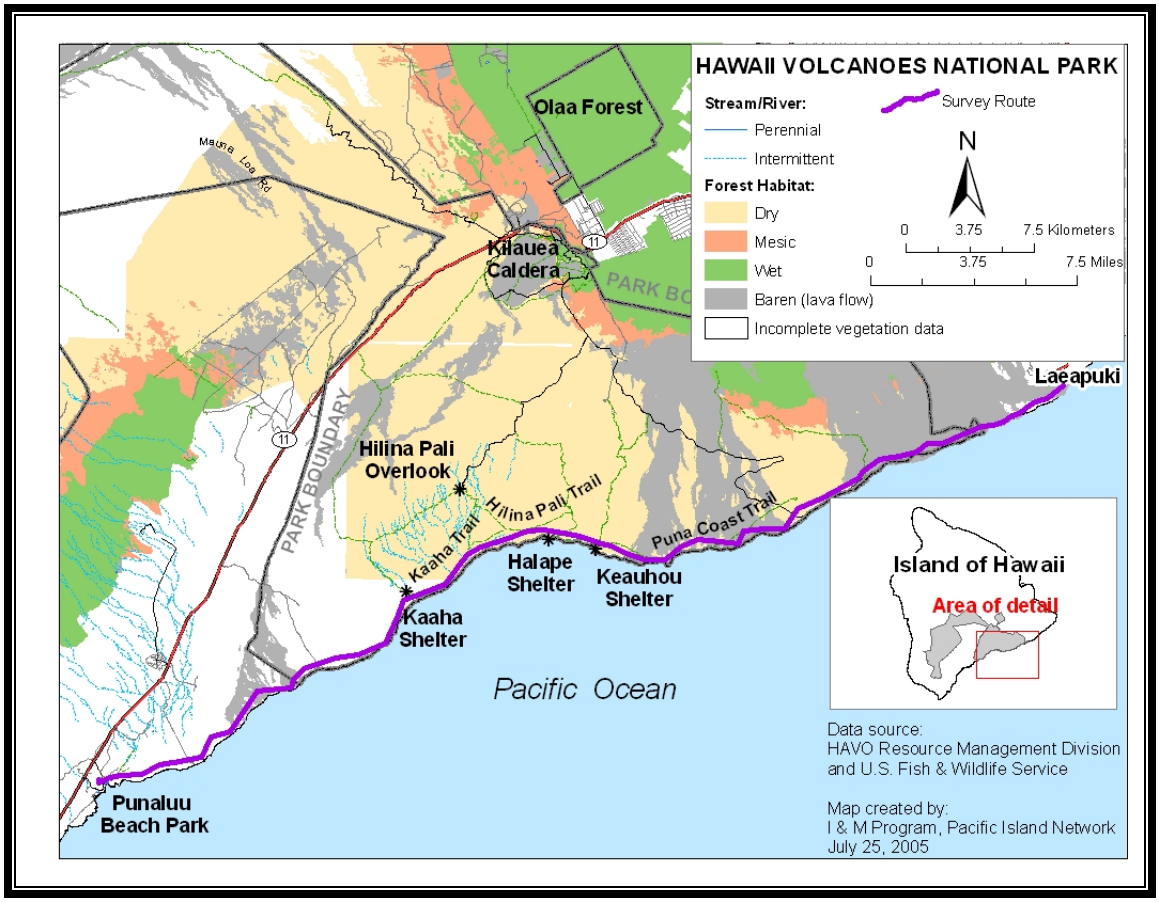

Figure 8. Map showing the shoreline bird inventory route from Punaluu Beach Park to Laeapuki within and adjacent to Hawaii Volcanoes National Park, 7-17 March 2005.

Surveyors scanned the coastline with Leica Trinovid binoculars at regular intervals but also watched for movement with the naked eye. When surveys veered from the cliff edge because of dangerous terrain, observers examined the coastline ahead and behind using binoculars. Birds detected aurally or visually at night or during lunch breaks were included. Sightings of shorebirds and seabirds were summarized in order to depict relative abundances of bird species and to locate areas of highest bird density. However, sightings of passerine species should be considered incidental as they were not the focus of this survey.

RESULTS

Kalaupapa National Historical Park

Three of the common migratory shorebirds, the Pacific Golden Plover, Ruddy Turnstone, and Wandering Tattler, were observed during the Awahua Beach to the Old Fishing Shack section of the survey on 5 April 2005 (Table 1; Figure 9). Both Pacific Golden Plovers and Ruddy Turnstones were found in the coastal strand, and the plovers were observed on sand and rocks, as well as grass/naupaka. The Wandering Tattlers were also found on the rocky shoreline. Wandering Tattlers and Pacific Golden Plovers were detected during the Old Fishing Shack to Waikolu Valley survey. No Sanderlings or Bristle-thighed Curlews were observed. No waterbirds were observed.

Seabirds observed were Great Frigatebird, Red-tailed Tropicbird, Wedge-tailed Shearwater, and White-tailed Tropicbird (Table 1). One booby species was observed near the offshore islets by Waikolu Valley; however, distance proved to be too great to positively identify the bird to species. It is likely that the species was the Red-footed Booby, as it has been sighted on a previous seabird survey and likely nests on the offshore islets (Hodges 1996). The Great Frigatebird and Red-tailed Tropicbirds were flying over land within 50 m of the sea during the Awahua Beach to Old Fishing Shack section of the survey. White-tailed Tropicbirds were seen throughout the survey, flying over the ocean close to high cliffs, and most commonly close to the offshore islets. No Black Noddies, waterfowl or raptors were observed during the survey.

Previously, two additional bird species have been observed incidentally at KALA (Table 4). Sooty Terns (*Sterna fuscata*) have been detected on foggy evenings over the Kalaupapa Settlement. The species has also been observed over Waikolu Valley during the Small Mammal and Forest Bird Surveys in March 2005. Several Black Noddies were detected along the rocky Kalawao coastline in September and November, during the 2003 inventory. Presently, there are several Black Noddies nesting in the rocky cliffs on the same coastline.

Kukaiwaa is a small peninsula located on the most northeastern point of the park. It is completely isolated by sheer cliff stretching to the native forest, 3000 ft above. During a recent trip in April 2005, several species of shorebirds and seabirds were recorded. Several Black Noddies were observed flying among the cliffs and feeding in the ocean. Two Wandering Tattlers were noted in and around the rocky shore and tidepools. Wedge-tailed Shearwaters were audibly observed in the evenings upon returning from sea. Burrows of Wedge-tailed Shearwaters have been documented on the nearby offshore islets (Guy Hughes, pers. Comm.). In years past, the rare Hawaiian Petrel (*Pterodroma sandwichensis*) was observed from the Kukaiwaa Peninsula (Bill Garnett, pers. comm.), but no observations were noted in 2005. Results from the radar survey conducted for the seabird inventory in 2002 suggest that both Hawaiian Petrels and Newell's Shearwaters nest in the valleys of northeastern Molokai, with the Pelekunu and Wailau valleys having the greatest potential for nesting birds (Day and Cooper 2002).

Table 1. *Relative abundance and habitat use of seabird and shorebirds observed during Kalaupapa National Historical Park Shoreline Bird Survey, 5-6 April 2005.*

Species	Scientific Name	# of Individuals	Habitat Use
Booby Spp.	*Sula spp.*	4	Air over water
Great Frigatebird	*Fregata minor*	1	Air over land
Pacific Golden Plover	*Pluvialis fulva*	20	Grass, grass/naupaka, rocks, sand
Red-tailed Tropicbird	*Phaethon rubricauda*	4	Air over land, water
Ruddy Turnstone	*Arenaria interpres*	5	Grass/ vegetation
Tropicbird Spp.	*Phaethon spp.*	1	Air over water
Wandering Tattler	*Heteroscelus incanus*	3	Rocks
Wedge-tailed Shearwater	*Puffinus pacificus*	2	Air over water
White-tailed Tropicbird	*Phaethon lepturus*	12	Air over water

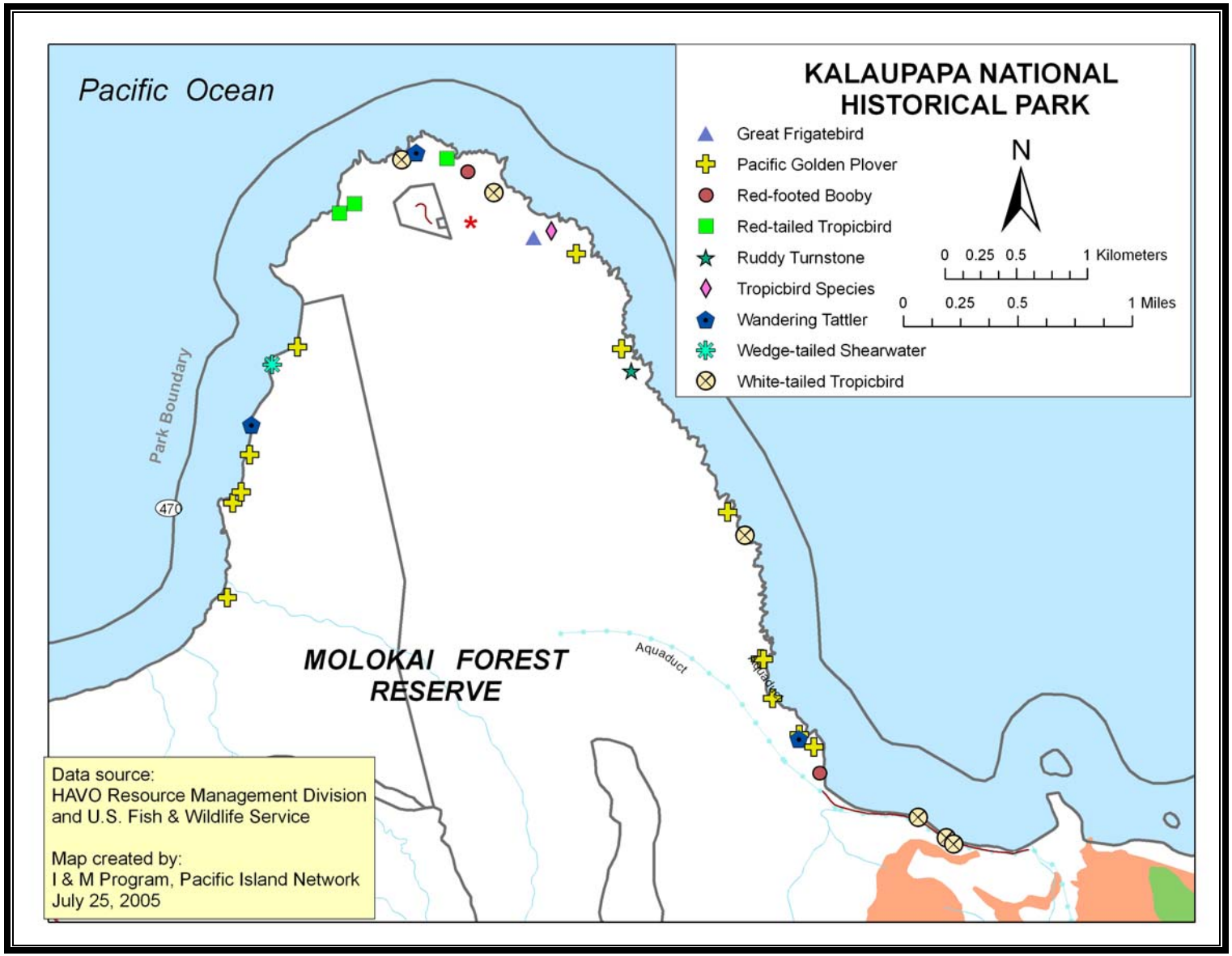

Figure 9. Map showing locations of shorebird and seabird observations in Kalaupapa National Historical Park, 5-6 April 2005.

Haleakala National Park

Three of the common migratory shorebirds, Pacific Golden Plover, Ruddy Turnstone, and Wandering Tattler, were observed during the Oheo Stream to Puhilele Point section of the survey on 30-31 March 2005 (Table 2). The Pacific Golden Plovers and Ruddy Turnstones were observed in open grassland, and the plovers were also noted on grass under naupaka and on rocks. The Wandering Tattlers were observed on rocky shoreline. No Sanderlings or Bristle-thighed Curlews were observed. The only waterbird, and the most abundant species observed during the survey, was the Cattle Egret (*Bubulcus ibis*).

Seabirds observed were Black Noddies, Great Frigatebirds, and one White-tailed Tropicbird (Table 3). The Black Noddies were seen flying close to the shoreline cliffs from Oheo Stream to Puhilele Point. One Black Noddy was observed flying back to its nest on a rocky outcrop. The Great Frigatebirds were flying high over the land within 100 meters of the sea. The White-tailed Tropicbird was seen flying over the ocean close to high cliffs in the Kaapahu section of the survey (Figure 10).

All of the shorebirds and the majority of seabirds (except the White-tailed Tropicbird) were observed in the Kipahulu portion of the coastline (Figure 11). No waterfowl or raptors were observed during the survey.

Table 2. *Relative abundance and habitat use of seabirds and shorebirds observed during Haleakala National Park Shoreline Bird Survey, 30-31 March 2005.*

Species	Scientific Name	# of Individuals	Habitat Use
Black Noddy	*Anous minutus*	6	Air over water, rocky ledge
Cattle Egret	*Bubulcus ibis*	55	Air over water, air over land
Great Frigatebird	*Fregata minor*	2	Air over land
Pacific Golden Plover	*Pluvialis fulva*	13	Grass, grass/naupaka, rocks
Ruddy Turnstone	*Arenaria interpres*	6	Grass
Wandering Tattler	*Heteroscelus incanus*	4	Rocks
White-tailed Tropicbird	*Phaethon lepturus*	1	Air over water

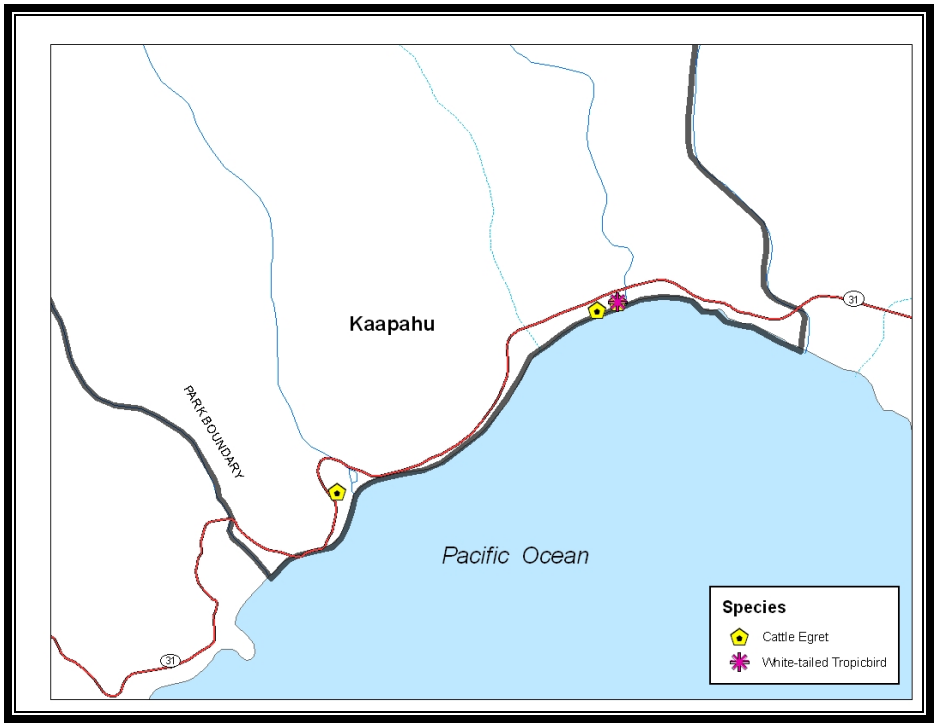

Figure 10. Map showing locations of shorebird and seabird observations in Kaapahu, Haleakala National Park, 30-31 March 2005

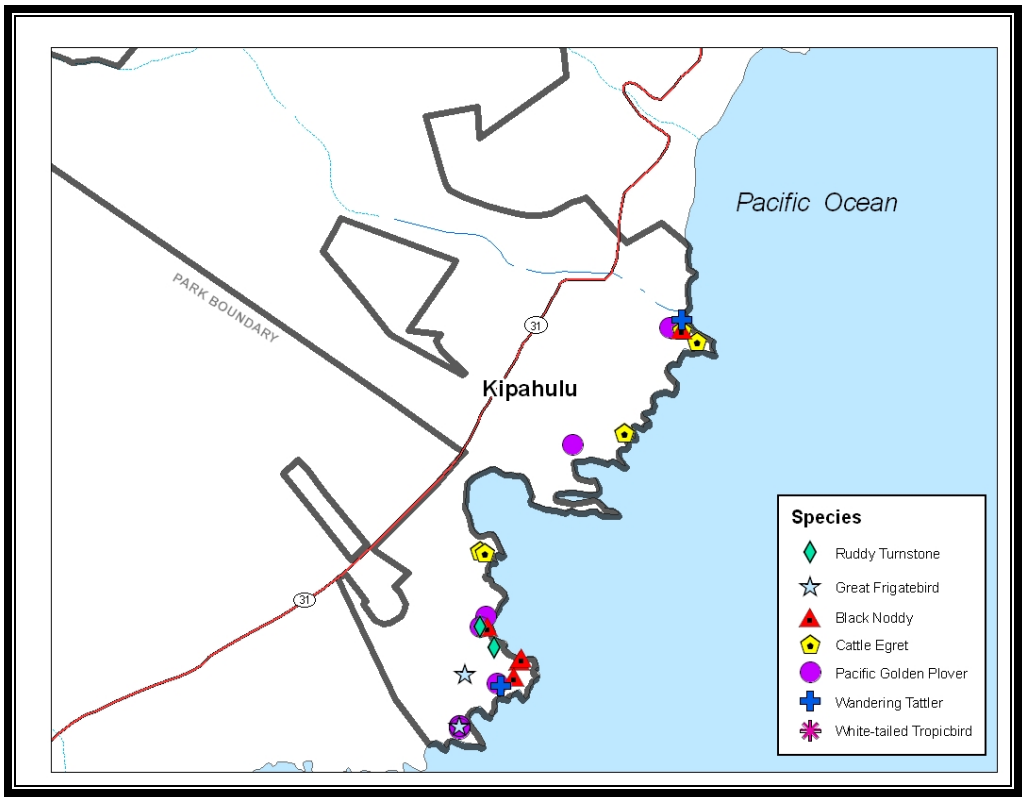

Figure 11. Map showing locations of shorebird and seabird observations in Kipahulu, Haleakala National Park, 30-31 March 2005.

Hawaii Volcanoes National Park

Three species of migratory shorebirds were documented on HAVO coastlines during the survey: Pacific Golden Plovers, Ruddy Turnstones, and Wandering Tattlers (Table 3, Figure 12). Wandering Tattlers and Ruddy Turnstones were most abundant near beaches, bays, inlets, and tidepools, and where the coastline was punctuated with small offshore islets. Pacific Golden Plovers were associated with sparsely vegetated lowlands adjacent to the coast.

Four species of seabirds were detected during this survey (Table 1, Figure 12). The Black Noddy was the only seabird species sighted along HAVO coastlines during the survey. Preferred habitats of Black Noddies were high ocean cliffs, especially those with archways eroded by ocean wave action. Three additional seabird species were detected aurally. White-tailed Tropicbirds and Sooty Terns were heard at night at Na Puu o na Elemakule on 7 March. Red-tailed Tropicbirds were heard at dusk at Apua Point on 10 March. In addition, one Wedge-tailed Shearwater carcass was collected along the top of lava cliffs near Naliikakani Point in southwestern HAVO; the cause of death is unknown.

Table 3. *Species relative abundance and habitat use in Hawaii Volcanoes National Park Shoreline Bird Survey, 7-17 March 2005.*

Species	Scientific Name	# of Individuals	Habitat Use
Black Noddy	*Anous minutus*	112	Over water off sea cliffs
Pacific Golden Plover	*Pluvialis fulva*	63	Sparsely vegetated pahoehoe
Ruddy Turnstone	*Arenaria interpres*	7	Sea cliffs & rocky shoreline
Red-tailed Tropicbird[1]	*Phaethon rubricauda*	Unknown	N/A
Sooty Tern	*Sterna fuscata*	2	Offshore
Wandering Tattler	*Heteroscelus incanus*	23	Sea cliffs, rocky shorelines
Wedge-tailed Shearwater[2]	*Puffinus pacificus*	1	N/A
White-tailed Tropicbird	*Phaethon lepturus*	2	Over water just offshore

[1]Auditory detection; [2]Remains of dead bird

Additional bird species have been noted incidentally within the study area (Table 4). One Black-crowned Night Heron was sighted at Keauhou Bay during lowland bird surveys on 4 May 2005. Newell's Shearwaters were heard at night at Apua Point by Hawksbill Turtle Project volunteers in June 2003 (HAVO Resources Management unpubl. data), and at night for a week at Keauhou Bay in mid-July 2005 (Will Seitz, pers. comm. 8/2/05). A park trail worker reported Newell's Shearwaters calling during two

consecutive nights at Kaaha on 19 May 2005 (Michelle Lane, personal communication, 5/25/05). Newell's Shearwaters and Hawaiian Petrels were tentatively identified staging offshore at Kaaha Beach on 28-29 June 2005 between 18:55 and 19:20 during seabird colony searches. One Bonaparte's Gull was sighted over the ocean during the day and one Wedge-tailed Shearwater was heard late at night at Apua Point during lowland bird surveys on 5 May 2005 (NPS Pacific Island Network, unpubl. data). One White Tern (*Gygis alba*) was tentatively identified flying inland during the day at Halape Iki, on 4 August 2005 (NPS unpubl. data).

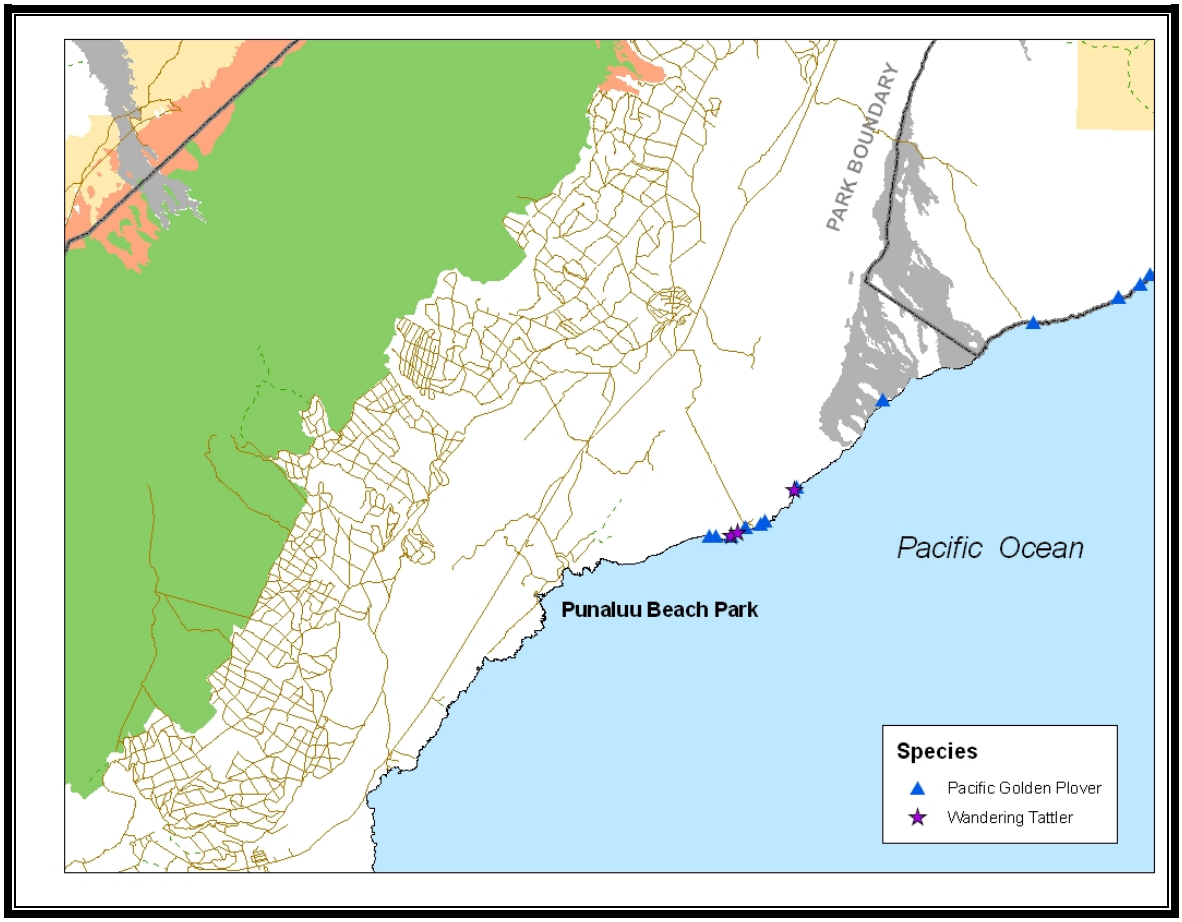

Figure 12. Map showing locations of shorebird and seabird observations along coastline adjacent to Hawaii Volcanoes National Park, 7-17 March 2005.

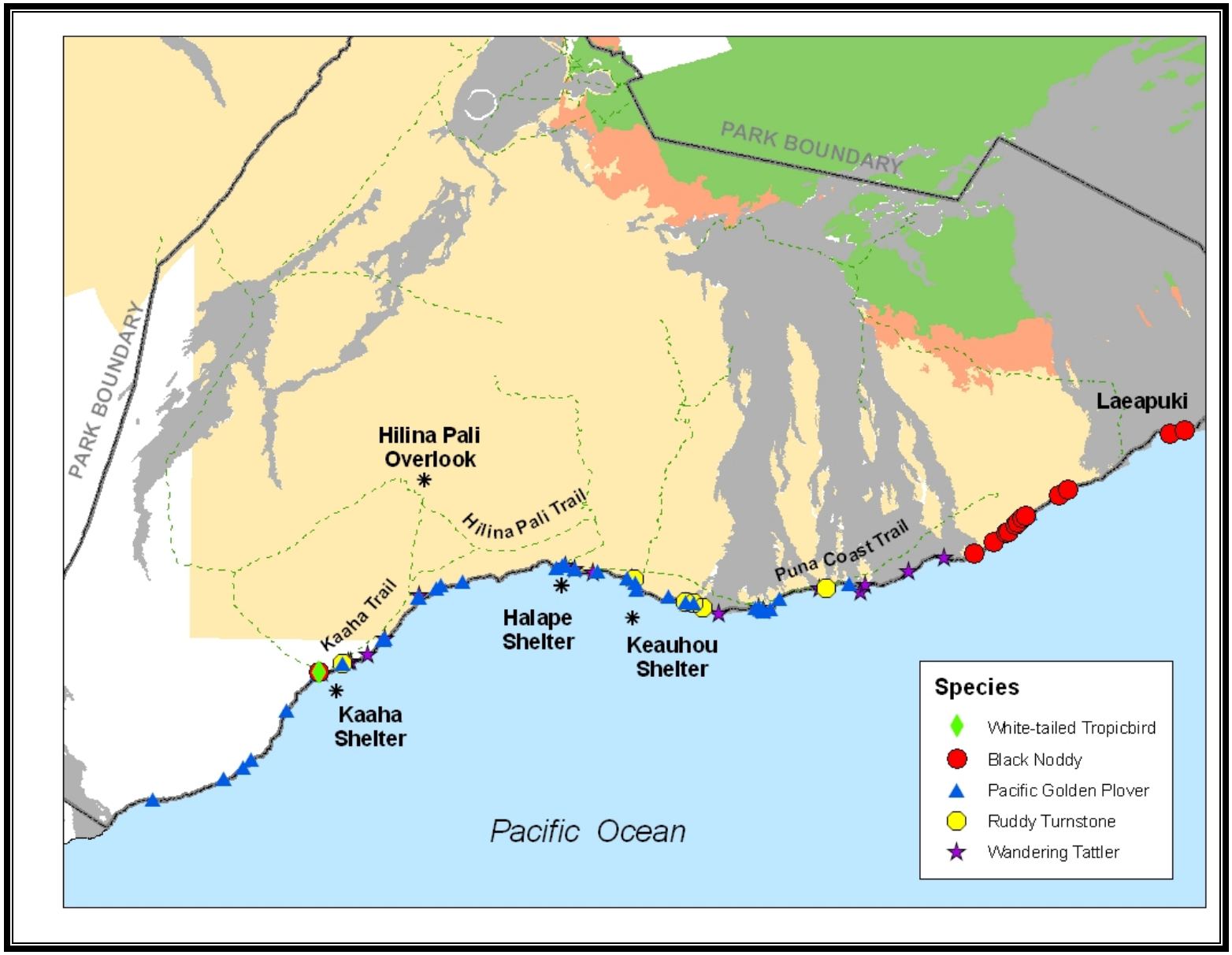

Figure 13. Map showing shorebird and seabird observations in Hawaii Volcanoes National Park, 7-17 March 2005.

Combined Results

A combined checklist of all species recorded during the inventories conducted at HALE, HAVO, and KALA, plus records from incidental sightings or auditory detections, are shown in Table 4.

Table 4. *Checklist of seabirds and shorebirds detected visually or aurally in Kalaupapa (KALA), Haleakala (HALE), and Hawaii Volcanoes National Parks (HAVO) during inventories in 2005. Included are also incidental observations from 2003-2005.*

Species	Scientific Name	KALA	HALE	HAVO
Black-crowned Night Heron	*Nycticorax nycticorax*	X		X
Black Noddy	*Anous minutus*	X	X	X
Bonaparte's Gull	*Larus philadelphia*			X
Brown Booby	*Sula leucogaster*	X		
Cattle Egret	*Bubulcus ibis*		X	
Great Frigatebird	*Fregata minor*	X	X	
Hawaiian Petrel	*Pterodroma sandwichensis*			X
Newell's Shearwater	*Puffinus newelli*			X
Pacific Golden Plover	*Pluvialis fulva*	X	X	X
Red-tailed Tropicbird	*Phaethon rubricauda*	X		X
Ruddy Turnstone	*Arenaria interpres*	X	X	X
Sooty Tern	*Sterna fuscata*	X		X
Wandering Tattler	*Heteroscelus incanus*	X	X	X
Wedge-tailed Shearwater	*Puffinus pacificus*	X		X
White-tailed Tropicbird	*Phaethon lepturus*	X	X	X
White Tern*	*Gygis alba*			X

* Unconfirmed sighting

DISCUSSION

The three national parks surveyed during this inventory contain coastline that has adequate habitat for migratory shorebirds. The open grasslands, strand vegetation, rocky cliffs and beaches provide habitat for the three shorebird species observed. Pacific Golden Plovers, Wandering Tattlers, and Ruddy Turnstones were observed consistently in every park surveyed. Pacific Golden Plovers were found in more terrestrial habitats, reflecting their generalist terrestrial habitat preference in Hawaii. The two other shorebird species recorded during the surveys, Ruddy Turnstones and Wandering Tattlers, were counted more often where marine food resources were accessible at areas washed over by waves such as offshore islets, sandy beaches, tidepools, and sheltered bays.

Shorebirds begin migration to their breeding grounds in early spring, so the timing of these surveys may have overlapped with the departure of some individuals. Since several of the Pacific Golden Plovers were observed in their breeding plumage, it is likely that individuals may have already set out for Alaska and Siberia. It is probable that by conducting the survey in the winter months of January and February, a higher number of shorebirds, and maybe a higher number of species, would be observed.

Although the coastline has good habitat for nesting seabirds, relatively low numbers of species and individuals of species were observed. This may be a reflection of the abundance of predatory threats to nesting birds. White-tailed Tropicbirds and Black Noddies nesting in rock cavities in steep cliffs may be able to avoid depredation by rats, mongooses and cats. Seabirds nesting in burrows, like the Wedge-tailed Shearwater, or on the ground or in short vegetation, such as Red-footed Boobies and Great Frigatebirds, are more vulnerable to alien mammal predators. Implementation of small mammal control would be beneficial to nesting seabirds and may attract more species to the coastlines of these parks. Despite the presence of introduced predators, a Black Noddy was observed on a nest during the HALE survey. The nest site was on a rocky ledge along a cliff, which would make it inaccessible to larger introduced mammals.

Depredation by introduced predators, habitat degradation, and competition with more aggressive species appear be the greatest threats to seabird and shorebird populations. The offshore islets of KALA provide potential predator free nesting habitat for seabirds, two islets are currently rat free. An attempt at rat eradication on these islets is recommended to relieve stress on breeding bird populations. Cats at KALA are fed by residents and tour groups. Feral cats are a sensitive issue within the Kalaupapa settlement, and any program to remove or reduce the feral cat population park-wide would require great delicacy. Currently there is only a trap, neuter, and release program being conducted (Guy Hughes, pers. comm.).

Excellent Wedge-tailed Shearwater nesting habitat is available along the northwestern coast of Molokai, within The Nature Conservancy's Moomomi Preserve. Through active small mammal management, the Conservancy has been able to increase the number of Wedge-tailed Shearwaters nesting in recent years (Samuel Aruch, pers. comm.). The entire coastal strand on the peninsula is potential nesting habitat for this species, but its current mongoose-infested state is not favorable for nesting seabirds. Utilization of a predator-free fence to create a habitat suitable for many nesting seabirds as well as the

Nene (*Branta sandvicensis*), or Hawaiian Goose, is a realistic goal that requires more thorough investigation.

Twelve Cattle Egrets were introduced to Maui in 1959 to help reduce the number of flies in ranch pastures (Breese 1959). Their adaptability to new environments and the availability of pasture land for foraging allowed the population to greatly increase and expand geographically. The birds prefer pastures near open water, a habitat that is plentiful along the coast in HALE. Cattle Egrets are known to prey on nestlings of the endangered Hawaiian Stilt (*Himantopus mexicanus knudseni*) and Hawaiian Coot (*Fulica alai*) and may be a threat to nesting seabirds as well (Andrews 1981). Cattle Egrets potentially carry disease such as *Salmonella* that may infect shorebirds and seabirds (Rauzon et al. 2004). The presence of numerous Cattle Egrets along the coast of HALE and the west Hawaii parks is a potential problem for nesting seabirds.

Another factor that may explain the low number of observed seabirds is the seasonal timing of the survey. Since most seabirds only come to shore to nest in the spring and summer, many may not have returned from sea at the time of the survey. Black Noddies are an exception as they nest in winter, occasionally extending into summer during years of inclement weather (Harrison 1990), which may account for the fact that we observed higher numbers of Black Noddies than of any other species.

Fewer Black Noddies were noted during the early part of the HAVO survey than at the end, even though the steep high cliffs in the western portion of the park seemed suitable Black Noddy nesting habitat. This difference may be attributable to observer error or timing. During the first day of the surveys, the rugged landscape made hiking difficult and may have affected observer ability. In addition, observer attention may not have been focused on the ocean but rather the shoreline, scanning for shorebirds. A visit to Na Puu o na Elemakule later in the season revealed two Black Noddies riding thermals at the sea cliffs. This observation suggests that more Black Noddies might be counted along the western coastline of HAVO later in the year.

Because shorebirds and seabirds are present on the main Hawaiian Islands at different times of the year, it would be advantageous to perform two surveys in order to increase the observation potential and timing it to when specific species are most numerous. A winter survey, conducted in November or December, would better document migratory shorebirds and winter nesting seabirds. A summer survey, conducted in June or July would document the presence of summer nesting seabirds.

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APPENDIX: SHORELINE BIRD HABITATS IN HAWAII VOLCANOES NATIONAL PARK

The first survey segment from the Kau boundary fence to Punaluu Beach Park was characterized by mainly pahoehoe lava, interrupted briefly by vegetated areas near Kamehame Beach and Punaluu Beach Park. Sea arches punctuated the coastline (Figure 14) and the native coastal strand plants naio (*Myoporum sandwicense*) and illima (*Sida fallax*), uncommon in HAVO, grow along this segment. Shorebirds were few in the first half of the survey where only one Pacific Golden Plover was seen. Pacific Golden Plovers (12) and Wandering Tattlers (3) were most common between Palima Point and Kamehame Hill.

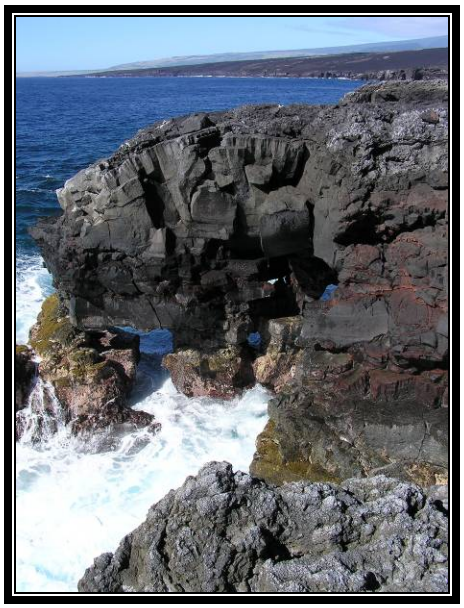

Figure 14. Survey segment one, the coastline between the western boundary of Hawaii Volcanoes National Park and Punaluu Beach Park. K. Schlappa, NPS Photo.

The second survey segment, from the Kau boundary fence to Na Puu o na Elemakule, was comprised mainly of barren unvegetated aa and pahoehoe lava cliffs (Figure 15), which represented poor shorebird habitat. Only six Pacific Golden Plovers were seen along this long segment of sea cliffs topped by sparse sedges, grasses, or portulaca. Wedge-tailed Shearwater bones were found at the top of the lava cliffs along this segment. Despite the miles of cliffs and occasional guano noted on the face of these cliffs, no Black Noddies were seen along this segment (see HAVO Discussion section). Segment two ended at Na Puu o na Elemakule, a littoral cone located where the Kaaha Trail first reaches the ocean below Pepeiao Cabin. This feature is an unconsolidated cinder hill covered mostly with weedy non-native vegetation such as sandbur (*Cencrus echinatus*) and Desmodium (*D. triflorum*). Future revegetation of the puu with native plants to anchor the substrate might improve seabird burrowing habitat, if accompanied by predator removal. A small inaccessible cobble beach regularly washed over by waves at the base of the puu appeared from a distance to be suitable shorebird habitat

Figure 15. Survey segment two, the coastline between the western boundary of Hawaii Volcanoes National Park and Na Puu o na Elemakule. R. Swift, NPS Photo.

Survey segment three, from Na Puu o na Elemakule to Kaaha, contained relatively good shorebird habitat during part of the survey near Opihinehe. Wandering Tattlers (2), Pacific Golden Plovers (2), and Ruddy Turnstones (1) used the sloping pahoehoe shoreline, tidepools and overwashed rocks covered with opihi (limpets), crabs, urchins, and algae. during the middle third of the segment at Opihinehe. However, the rest of the survey was relatively low quality habitat for shorebirds. Low pahoehoe cliffs dominated the shoreline for most of the first third of the survey and were not good shorebird habitat. The final third of the survey along low pahoehoe cliffs, covered with cobble, appeared to be unsuitable habitat for shorebirds. It was apparently washed over only during the extreme weather events which transported the cobbles to the top of the cliffs. Even so, Wandering Tattlers (2) and Pacific Golden Plovers (2) were counted along this section. The count was abandoned approximately 1 km west of Kaaha due to lack of water for the observers.

Segment four encompassed Kaaha Bay (Figure 16) and the shoreline east to Kalue. The sheltered cove and shallow waters along Kaaha Bay provided good foraging habitat for shorebirds including Wandering Tattlers (1) and Pacific Golden Plovers (4). Some plovers were flushed out of periodically inundated channels where saltwort (*Batis maritima*) thrived (Figure 17). The sparsely vegetated lava shoreline between Kaaha and Kalue appeared to be adequate habitat for Pacific Golden Plovers; two plovers were seen along that route. One Pacific Golden Plover was noted on the small black sand beach (Figure 18) at Kalue. A large cobbled berm fronted the ocean (Figure 19) but due to the high wave action, the beach berm did not appear to be good shorebird habitat. A brackish seep at Kalue took the form of small pools in the cobble berm. Though Kalue seemed like good habitat, only one Pacific Golden Plover was seen there. Apparent seabird guano was

recorded under a rocky overhang southwest of Kalue Beach, but two subsequent checks showed no recent activity.

Figure 16. Kaaha Bay, at the start of survey segment four. R. Swift, NPS Photo.

Figure 17. Periodically inundated areas adjacent to Kaaha Bay. R. Swift, NPS Photo.

Figure 18. Small black sand beach at Kalue Bay, at the end of survey segment four. K. Turner, NPS Photo.

Figure 19. Steep cobble berm at Kalue Bay, at the end of survey segment four. K. Turner, NPS Photo.

Survey segment five was a short segment extending from Halape Beach to Halape Iki. The small sheltered bay and small sandy beaches of both locations were good shoreline bird habitat (Figures 20 and 21). Three Pacific Golden Plovers and one Wandering Tattler were seen at Halape alone. Both locations also have freshwater cracks with milo (*Thespesia populnea*) and kou (*Cordia subcordata*) trees which may attract both shorebirds and introduced passerines. The short segment of coast between Halape Beach and Halape Iki was characterized by low pahoehoe shoreline topped by cobble. One Pacific Golden Plover was seen along this stretch. No shorebirds were seen at Halape Iki,

despite its sandy beach and sheltered bay, possibly because of human presence. Halape Iki is a popular and frequently visited camping area.

Figure 20. Small black sand beach at Halape. K. Turner, NPS Photo.

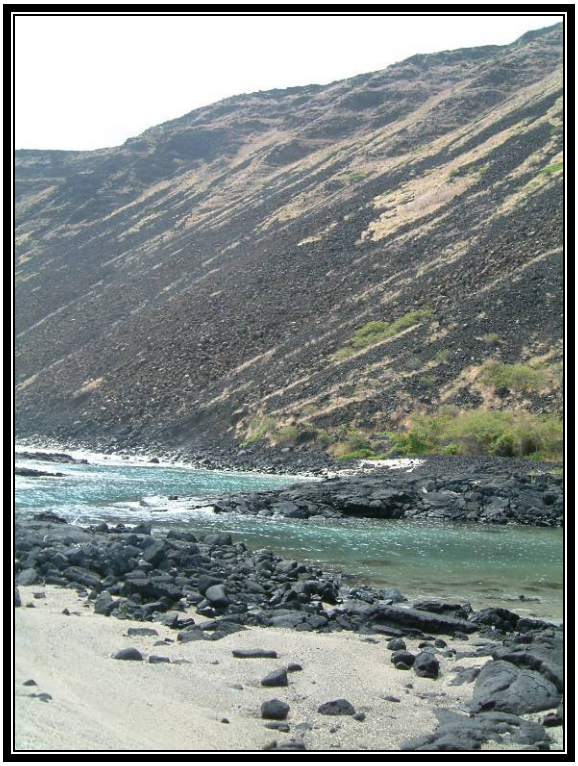

Figure 21. Small sand beach at Halape Iki. R. Swift, NPS Photo.

The first section of survey segment six, from Halape to Keauhou, was good habitat for Pacific Golden Plovers (2) and Wandering Tattlers (2). This section was characterized by sloping pahoehoe shoreline with a cobble berm on top, changing to low pahoehoe cliffs, and high cliffs topped by grassy lowlands. Along the second half of the segment, after descending the pali, the low pahoehoe shoreline was covered with cobble and boulders, but no shoreline birds were seen until near the sheltered bay at Keauhou (2 Pacific Golden Plovers). The sand beach, tidepools, and anchialine pools of the two adjoining bays at Keauhou are prime habitat for shorebirds including Pacific Golden Plovers (4), Wandering Tattlers (1) and Ruddy Turnstones (2), all of which were noted there (Figure 22). Alien songbirds flocked in the milo trees, surrounding the anchialine pools.

The second section of survey segment six, the shoreline between Keauhou Bay and Apua, provided numerous shorebird detections including Pacific Golden Plovers (3), Wandering Tattlers (3), and Ruddy Turnstones (2). Some of the low pahoehoe cliffs along this stretch were covered with cobbles and boulders. In other places, beach berms made up of cobble, pebble, and coral met the ocean (Figure 23). Tidepools, anchialine pools (Figure 24 & 26), and areas with tussocky rushes that appeared to be periodically inundated were found upland of the berm and provided shoreline bird habitat (Figure 25).

The large tidepool, small bay and cobble headland at Apua Point provided habitat for Pacific Golden Plovers (4) and Wandering Tattlers (2). The sparsely vegetated naupaka lowlands of Apua Point are used by Pacific Golden Plovers (2).

Figure 22. Shoreline bird habitat at the westernmost of the two bays at Keauhou. R. Swift, NPS Photo.

Figure 23. Shoreline between Keauhou and Apua Point. R. Swift, NPS Photo.

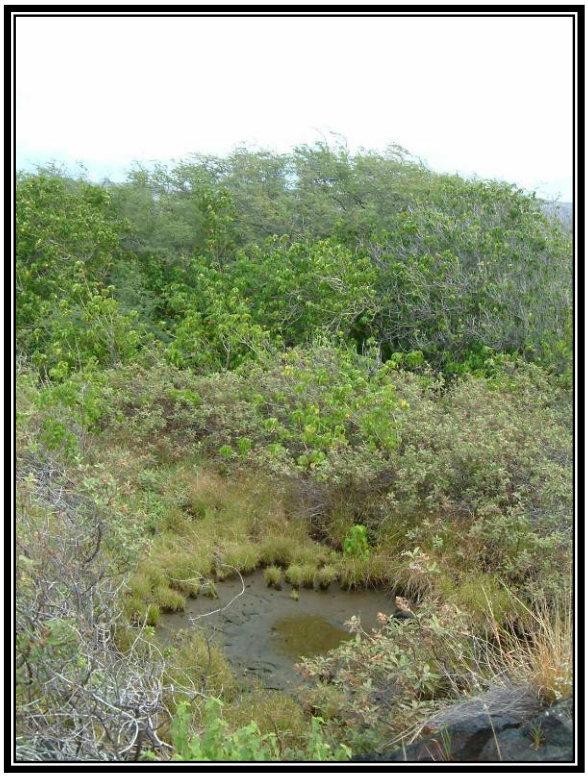

Figure 24. Anchialine pool between Keauhou and Apua Point. R. Swift, NPS Photo.

Figure 25. Areas which are apparently periodically inundated behind cobble berm between Keauhou and Apua Point. R. Swift, NPS Photo.

Figure 26. Anchialine pool between Keauhou and Apua Point. Swift, NPS Photo.

The third section of survey segment six, between Apua Point and Chain of Craters Road (Figure 27), provides good shoreline bird habitat from Apua Point to Kahue Point. The low pahoehoe cliffs along this coastline contain tidepools on top which receive wave overspray (Figure 28). Offshore rocks covered with pink crustose coral and algae (Figure 29) provide foraging opportunities for Wandering Tattlers (3) and Ruddy Turnstones (1). Pacific Golden Plovers (2) also utilized the lowlands. The second half of survey segment six from Kahue Point to Chain of Craters Road had poor shorebird habitat. Pahoehoe cliffs became taller, newer barren lava dominated, and the frequency of tidepools was

diminished. However, the habitat seemed better for noddies, especially during the last third of the survey segment which was mostly high pahoehoe cliffs with sea arches where Black Noddies (8) were seen flying in and out of arches (Figure 30) and perching on cliff ledges.

Figure 27. Shoreline between Keauhou and Chain of Craters Road. R. Swift, NPS Photo.

Figure 28. Algae-covered rocks used by a Ruddy Turnstone between Apua Point and Kahue Point. R. Swift, NPS Photo.

Figure 29. Large tidepool used by Wandering Tattler between Apua Point and Kahue Point. R. Swift, NPS Photo.

Figure 30. Sea arches, used by Black Noddies, between Kahue Point and Chain of Craters Road. M. Hughes, NPS Photo.

The tall pahoehoe coastal cliffs of survey segment seven, along the coastal segment of Chain of Craters Road, was habitat for a great number of Black Noddies (97). Sea arches and noddy roosts, evidenced by guano on the cliff faces, were seen (Figure 31). Pacific Golden Plovers (2) also utilized the sparse vegetation above the cliffs.

Figure 31. Holei sea arch, along the coastal segment of Chain of Craters Road. K. Turner, NPS Photo

The final segment of the shoreline bird survey, segment eight, began at the end of Chain of Craters Road and ended near the active lava flow at Laeapuki. This section of the coast was mainly new black lava with some sparely vegetated pahoehoe on the top of cliffs. Habitat appeared inappropriate for shorebirds; however, Black Noddies (5) were observed.